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CONTENTS

Erratum: In the article "New Laser Excitation Process for Uranium Isotope Separation" published in JPRS-CST-90-013, 3 May 1990, pp 17-19, all references to "liquid uranyl formate" should read "hydrated uranyl formate."

SCIENCE & TECHNOLOGY POLICY

AEROSPACE

BIOTECHNOLOGY

COMPUTERS

MICROELECTRONICS

SUPERCONDUCTIVITY

TELECOMMUNICATIONS R & D

PHYSICS

Li Xu'e on 1990 S&T Development Plan

90FE0067A Beijing KEJI RIBAO [SCIENCE AND TECHNOLOGY DAILY] in Chinese 10 Mar 90 p 1

[Article by Han Yuqi [7281 3768 3825] and Wang Jianmin [3769 1017 2404]]

[Text] Deputy Director of the Standing Committee of the State Science and Technology Commission Li Xu'e [2621 4872 6759] proposed eight tasks in the National Working Conference on Science and Technology that was held on 5 March.

After briefly reviewing the reform of China's science and technology system, Li made his requests on future work. He said that the reform of the science and technology system begins from within the S&T system and then extends to promoting S&T advances in rural agriculture and in enterprises. In practice, the emphasis should be on the commercialization of technical products, development of technical markets, and reform of the funding allocation system for S&T. Under the reform movement, a new operation system for S&T has been established; in addition, S&T development in three areas has been formed. These are economic development, high-tech tracking and enterprise development, and the strengthening of fundamental research. S&T development projects with different goals and for different topics have also been gradually formed.

Li said that promoting science and technology is a long-term task and the job at hand is centered on consolidation and management. In the meantime, we must lay down the relationships to serve the current economic development and to serve future development. In 1990, S&T endeavors will move forward in the following eight areas, as summarized below.

1. Establish the policy of building up agriculture with science and technology and promote S&T in the villages. Establish and perfect an agricultural S&T production service system based on the practice of providing technical services with compensation. Promote currently available agricultural S&T research results so that benefits may be drawn from the applicable results. Strengthen the investigation of major agricultural problems so that big science may help big agriculture.

2. Take all necessary action to make industrial production truly reliant on advances in S&T and follow the path leading to economic benefits. Establish an evaluation system to examine the technical advances of enterprises. Establish and perfect a chief-engineer responsibility system under the leadership of the plant director. Clearly define the rights and responsibilities of the chief engineer and further improve the technical development and production-technology management system of the enterprises. Establish technology development departments in large and medium enterprises and business groups as soon as possible. Small enterprises and village businesses should form their own technological backup through various approaches. The State Science and Technology Commission has decided to promote 300 research results in 1990 and expects to achieve 18 billion yuan of annual output value and 3 billion yuan of taxes.

3. Adopt a policy to help high tech to grow. In 1990 there will be 200 national projects and 50 preparatory projects. Major projects with new increases in output value in excess of 10 million yuan will be given high priority. Following the formation of the development zone in Beijing, the State Council has recently approved 20 new high-tech development zones for preferred tax treatment in 1990. With other conditions being equal, the 1990 national "Torch Plan" projects will be given to the high-tech development zones.

4. Let research institutes play their role in importing technology and absorbing new technology. Based on the resources at the research institutes and universities, selectively import medium and small items for integration and domestication.

5. Continue to enhance the depth of S&T development so that economic and technological development can last. In 1990, a large number of major basic research topics need to be organized and implemented. Tasks of fundamental research for the Eighth 5-Year Plan should be determined. Strive to complete the tasks in the "863" project for the Seventh 5-Year Plan. Further scrutinize the strategic goals in information, energy, and new-materials areas. Continue to work on the Seventh 5-Year Plan projects and organize the projects under the Eighth 5-Year Plan according to the requirements of national industrial policy and the needs of industrial reform.

6. Continue to promote coordinated economic and social development based on scientific and technological advances. The State Science and Technology Commission has decided to emphasize the following work: to control the rapid increase in population, to improve the ecological environment, to make sensible use of resources, and to ensure production and public safety.

7. Strengthen international exchanges and cooperation in S&T while adhering to our principles and overcoming the sanctions. In international activities in S&T, adhere to the "Opinions on the present international S&T cooperation and exchange" put forth by the State Science and Technology Commission and approved by the State Council. The fifth working conference on S&T and foreign affairs will be held in 1990.

8. Other work in S&T. The State Science and Technology Commission will be drafting the 10-year plan for S&T efforts from 1990 to 2000. Also in 1990, the "Atomic Energy Act," the "Research Institute Act," and the "S&T Awards Act" will be drafted and sent to the State Council for approval. Technology policies on the ocean, geology, and weather will be formulated in consultation with the relevant departments. The S&T management system will be further improved.

Song Jian on S&T Reform

90FE0067B Beijing BEIJING KEJI BAO [BEIJING SCIENCE AND TECHNOLOGY NEWS] in Chinese 10 Mar 90 p 1

[Article by Hao Meifang [6787 2734 5364]]

[Text] In the national S&T working conference sponsored by the State Council, Council Member Song Jian [1345 0256] announced that the State Council lends its full support to S&T system reform and has decided to provide further support for high-tech development.

Song said that China's S&T system reform is an important ingredient of the socialist reform. In the 5 years since the Party Central Committee made the "Decision to reform the science and technology system" in March 1985, a number of major reform measures have been made in operations, organization, and the personnel system. The directions are correct, the effects are prominent and the policies and their implementation are basically successful. The reform action is consistent with the world trend in science and technology development and appropriate for China's situation. It must be adhered to firmly.

Song stressed that there have been historical changes in China's S&T system. A new mechanism combining S&T and the economy is gradually taking shape, and a fair number of research institutes have successfully moved forward on a new path. They have overcome difficulties, increased their vitality, moved S&T forward, and achieved encouraging results. A number of technological institutes have entered the economic arena and obtained much greater scientific and technological, economic and social benefits. With the support from the Chinese Academy of Sciences (CAS) and the universities, more than 800 high-tech companies have been formed in the rapidly growing Beijing New Technology Industrial Development Experimental Zone. In 1989, these companies generated an output value of 1.78 billion yuan, paid 73 million yuan of taxes, and earned more than US$30 million in foreign exchange. The Beijing Municipal Government and the relevant departments of the central government have strongly supported these high-tech companies, which have received praise from the State Council and Beijing municipality. Many technology development institutes have also formed leading-edge enterprises and obtained international achievements. For example, Institute No 15 of the Ministry of Machine-Building and Electronics Industry entered the international market with its Taiji superminicomputers. Beijing University has commercialized its laser Chinese typesetting technology, which was popularly received on the domestic and foreign markets. In addition, the neodymium-iron-boron magnetic material developed by CAS and the optical crystals developed by [CAS's] Shanghai Institute of Silicates and [CAS's] Fujian Institute of Material Structure have both entered the international market. The birth and growth of many civilian research institutes has opened up new avenues and accumulated new experience for China's S&T development and reform. The State Commission of Science, Technology and Industry for National Defense and the Ministry of Aeronautics and Astronautics Industry are launching satellites for the international market. This activity not only generates huge economic payoffs but also major political benefits to go with them.

Song hopes that everyone in the S&T profession understands that reform and openness are the way to make China strong. He said that countries incapable of competing in the international arena with high tech will only be ignored, discriminated against and taken advantage of. He said that the State Council has decided to help enterprises in the high-tech development zones in the various provinces and municipalities.

The State Council will further aid and encourage the academies, institutes, universities, and large and medium enterprises to organize high-tech businesses and enter the market. Such outgoing business activities will be treated with preference by the State Council and governments at various levels, banks, tax departments, and foreign affairs offices. Such companies and enterprises already started should be protected and assisted so that they may grow stronger and gradually become the main force in the internationalization of China's high-tech industry.

Song made it clear that China will make a major effort in exporting products of high added value, electromechanical products, and high-tech products. Their percentage of total exports will be increased. This is very important for the advancement of technology, rate of production, per-capita income, and international competitiveness. Such activities should receive more help in policy, capital, and foreign-affairs privileges. Efforts should continue to train a group of management personnel who are experts in special technologies, familiar with the international situation, and fluent in foreign languages. We should strive to attract overseas Chinese students to participate in outgoing high-tech industrial activities.

Creation of Key National Laboratories Surveyed

90CF0321A Beijing ZHONGGUO KEJI LUNTAN [FORUM ON SCIENCE AND TECHNOLOGY IN CHINA] in Chinese 18 Jan 90 pp 43-45

[Article by Chen Qinglong [7115 3237 7893]: "Key National Laboratories Being Created and Developed"]

[Text] Recently, China's institutions of higher education have eagerly promoted reform, have made vigorous efforts to break new ground, have vigorously created favorable conditions, and have used a variety of channels, such as state investments, fund raising and World Bank loans, to create a group of key national laboratories. Thirty-four such laboratories have been created and equipped at institutions of higher education since 1984. Eight of them passed state acceptance tests in 1988, and

four more have since been accepted: the Beijing University Visual and Auditory Information Processing Laboratory, the Qinghua University Friction Laboratory, the Xi'an Jiaotong University Strength and Vibration of Mechanical Structures Laboratory, and the Wuhan University Software Engineering Laboratory. The construction of 50 more key national laboratories is planned for the next 2 years. It is estimated that by about 1993, China will have nearly 100 laboratories at institutions of higher learning throughout the country.

The creation of these laboratories is a new development that has emerged since China instituted reform and opening to the outside. The combination of their major potential importance and their visible features have attracted the serious attention of domestic and foreign scholars and have won them high praise. We may expect that their extreme vigor will result in their continuous development.

1. The Creation of the Key National Laboratories Has Provided Essential Preconditions for Developing Key Fields

The institutions of higher education offer the full complement of fields of study, comprising both natural sciences and social sciences. The four major categories of science, engineering, agriculture and medicine, include more than 60 fields of study at the elementary level alone; but unreasonable organizational structure, imbalances and lack of coordination have rendered them unsuited to the needs of national economic development. As a result, the readjustment and strengthening of weak course areas, support for the growth of new and borderline fields, and accelerated modernization and transformation of traditional fields are new tasks in the reform of higher education. Because some institutions of higher education are large in size but suffer from imbalances in their development, many experts have long advocated the systematic creation of key laboratories at appropriate institutions of higher education to stimulate the development of science as a whole and to evolve a balanced, integrated research system suited to the needs of economic construction and social development.

Naturally, the development of key fields is many-sided and includes personnel development, teaching materials development, and the creation of laboratories. But laboratories should be founded on economic strength, and the institutions of higher education are currently short of funds and material resources, so that the creation of laboratories would not be able to bring about a universal flowering of higher education; as a result, the construction of key national laboratories has had to be subjected to systematic, comprehensive critical evaluation. The state had already specified that key laboratories can be created only where suitable conditions exist and that their creation must be based on peer evaluation and competitive funding, with systematic, stagewise construction; in particular, in addition to motivating the various central departments, it would also be necessary to motivate the local governments and the institutions of higher education, to focus on intensifying the development of key fields, and to strive, consistent with needs and capabilities, to create conditions favoring their development.

The 30-odd key national laboratories that have been set up by the institutions of higher education in recent years cover nearly 100 key fields, including not only basic fields (e.g., physics, chemistry and biology), but also many new fields (such as bioengineering, new materials, information science and technology and the like). The 60 additional laboratories to be created in the next 2 years will cover more than 100 additional key fields, and people will feel their direct benefits. When these key laboratories are created, they will become not only research centers, but also educational centers, which gives them profound and far-reaching significance.

2. The Key National Laboratories Are a Major Base for Developing Science and Technology

The institutions of higher education are a vigorous force on China's science and technology front. In addition to providing advanced education and training, they also have major tasks in developing science and technology. But for various reasons, China's institutions of higher education have long received far less funding than the research units of certain major academies and institutes. Not only have research funds been scarce, but the instruments and equipment used for scientific research have been outmoded, which has hindered the effective use of the schools' capabilities. In the present day, when economic development invariably relies on science and technology and when science and technology necessarily serve economic development, without advanced instruments and equipment it is impossible to run a top laboratory or to engage in complex technological design and it is very difficult to complete national research breakthrough projects.

Some developed countries have attached appropriate importance to developing science and technology in order to maintain their economic competitiveness; they have spared no expense or effort to create a variety of modern national laboratories and to provide them with the most advanced instrumentation, equipment and laboratory facilities that will accelerate research and development in high-technology and new-technology fields. For example, MIT's materials science and engineering laboratory in the United States and Cambridge University's Cavendish Laboratory in England are famous for their modern instrumentation and equipment and also for the fact that their top-flight research and development results maintain them as world leaders in science and technology. Although China's financial capabilities are limited and China is unable to compete in terms of intensity and breadth of investment, we believe that much of the valuable experience of these other countries' establishment of key national laboratories is worth drawing on. Naturally, when we establish such laboratories, we must proceed on the basis of China's real situation, and not uncritically follow foreign

models. We must concentrate on our own country's circumstances, make use of our own advantages and act in terms of our own characteristics.

During the recent creation of key national laboratories at institutions of higher education, we have also brought in certain advanced instruments and equipment; such planned technical support is a necessity. The key national laboratories that we have equipped in this way have already developed many high-level laboratory techniques and have made important contributions to key national research projects, to keeping up with and developing high technology and new technology, and to basic research and applied basic research. It is estimated that in the Seventh 5-Year Plan, these key laboratories have taken on more than 300 state and departmental research topics, and a considerable number of their research results are at the domestic or international state of the art. For example, Nanjing University's solid state microstructure physics laboratory focuses on a leading-edge field of solid state physics; it has performed groundbreaking theoretical and experimental work in such major fields as defect physics, phase-transition physics, and new materials. Not only has it contributed well-received advanced articles to domestic and foreign publications and conferences, but several of its concrete research results are already at the domestic or international state of the art. In addition, since Shandong University's crystalline materials laboratory imported such major facilities as organometallic chemical vapor deposition equipment and integrated systems for measurement of the electrical characteristics of crystals, it has perfected various crystal-growing techniques and measurement procedures, thus rapidly developing a variety of new crystalline materials with various specifications and properties, whose technical characteristics are at the international state of the art, and several products have already entered international markets.

3. The Key National Laboratories Have Provided an Excellent Environment for the Nurturing of Advanced Specialists

The institutions of higher learning perform the task of nurturing advanced specialists for China's socialist construction. About 80 percent of the Ph.D. and M.A. students in the country were trained by the institutions of higher learning. The training of personnel in the natural sciences is closely connected with the establishment of laboratories. Although book learning, mastery of scientific theory, and advanced analytical and problem-solving capabilities are necessary components of the training of scientists, they must all exemplify the connection of theory with reality. And connecting theory with reality requires involvement in practice and thus the acquisition of scientific data in the laboratory in order to prove the correctness of theory, to infer new scientific principles, and to create new technologies. Laboratory work can inspire people, make them think, and train them in a rigorous scientific spirit. The current tasks of all of the institutions of higher learning in the training of graduate students are heavy, but the laboratory research conditions that they can provide are extremely limited. It appears that research facilities are a major factor in the rather large gap between the developed countries and China in the training of graduate students. While it is true that uncritical competition with others that does not take account of China's financial and material conditions is unhelpful, it is both necessary and possible to strive wholeheartedly for the establishment of a group of solid laboratories, consistent with China's conditions. Selective, focused establishment of national laboratories will provide an excellent environment for nurturing high-quality graduate students.

In the last few years, the key national laboratories in the institutions of higher learning have already made a contribution to the training of specialists. First, they have provided research facilities for graduate students. In 1988, about 500 graduate students were engaged in scientific research in the laboratories, and the strengthening of their research abilities has been indicative of an improvement in their overall capabilities; many have made excellent contributions in their subsequent jobs. Second, they exercise a definite attraction to personnel returning from study abroad. After the present author wrote an article in the journal SHENZHOU XUEREN describing China's key laboratories, many students working on Ph.D.'s abroad wrote to praise it as a far-sighted measure and expressed a desire to make a contribution at these laboratories.

4. The Key National Laboratories Provide the Material Foundation for Working Out a New System

Scientific and technical development is ever-changing. To date, the interaction, interpenetration and integration of different fields has become a marked tendency, indicating that the major scientific and technical breakthroughs of the future are unlikely to result from reliance on isolated fields. As a result, the key laboratories of certain developed countries devote a great deal of attention to exchange and cooperation. They open their laboratories to a wide range of people from all spheres both in their own countries and from abroad, inviting them to participate in joint research in order to accelerate the achievement of research breakthroughs. For example, Stanford University's synchrotron radiation laboratory in the United States, the materials laboratory of Kelaosida'er [phonetic] Engineering College in the FRG, and Canada's state meson research laboratory all operate "open-door" laboratories in order to promote cooperative research by scientists and engineers in numerous fields; their rapid, effective results have become a byword. But before China's reform and opening to the outside world, some laboratories were closed, not only to the outside world, but even to domestic exchange, so that research results were scanty, and instruments and equipment were long idle or received little use. Some organizations had personnel but lacked instruments and equipment, while others had instruments and equipment but lacked personnel, which

not only resulted in wastage of manpower and of financial and material resources, but also made research activities rigid and inflexible, so that the academic atmosphere was stifling and did not promote the development of able people or good results. Now that we have set up key national laboratories in the course of reform and are no longer limited to traditional procedures, we suggest that the research laboratories open their doors to the outside world and promote personnel mobility and academic exchange; this new system will unquestionably help to raise the level of research and improve the training of able personnel.

There is not yet complete unanimity regarding the implications of the opening of key national laboratories. We believe that since we are opening the research laboratories, we should not merely make a few advanced instruments and equipment available to others: instead, we should make the subject matter and approaches of research public and attract people from outside to participate in the research, in order to reap the advantages of bringing together talent and brainpower by obtaining better research results. This is the only way to realize the characteristics of the new system of mobility and opening up. Several dozen existing research laboratories have received authorization and have opened up to the outside world, and some of the laboratories that are under construction have opened even during the construction process; the results have been good. In 1988, laboratories that had opened to the outside had already received more than 200 research personnel, more than half of them visiting researchers.

In order to assure that the new system is implemented, every current open-door laboratory has set up an academic committee composed of top domestic and foreign (but primarily domestic) scientists. This authoritative body is responsible for evaluating research focuses, authorizing research outlines, evaluating major research results, and considering the creation and opening up of laboratories. This makes the laboratories maintain high-level, highly efficient operations and thus also has won them more recognition.

The establishment and operation of China's key laboratories has resulted in excellent achievements, and they have already been welcomed at home and abroad and have received high praise, but we are also experiencing many difficulties in moving forward. For example, the laboratories' operating and open-door funds are still a constraining factor on our development, and we have yet to open up diversified funding channels. As a result, in addition to the efforts made by well known universities and their key laboratories, we must also strive to secure support and assistance from various quarters of society. We must strive to use all favorable factors in order to make a success of the key national laboratories.

Versatility of Big SH-5 Flying Boat Described

90CF0366A Beijing HANGKONG ZHISHI [AEROSPACE KNOWLEDGE] in Chinese No 2, Feb 90 pp 22-23

[Article by Wang Hongzhang [3769 3163 4545], Yao Hua [1202 5478], and Li Hongtao [2621 3163 3985]]

[Text] China is a country with a large landmass and more than 18,000 km of shoreline; it also has over 5,000 islands with a total shoreline of more than 14,000 km. According to the 1982 "Treaty on Ocean Law" established by the United Nations, China's continental shelf and its 200-n.m. exclusive zone contains more than 3 million square kilometers, which is approximately one-third of China's total territory. The rich resources contained in this extensive ocean region will be a significant factor in the survival of the Chinese people during the next century. The resources in the open sea beyond the 200-n.m. limit belong to the entire human race on this planet; therefore the Chinese people also have the right to develop and exploit these resources. The question is whether we have the technologies and production capability to develop these resources, and whether we have the military capability to protect these resources. At present, some other countries have included part of China's ocean territories on their maps, and some of China's islands are being occupied by other countries. These countries have taken the liberty of removing marine lives and products from China's territorial waters and exploring and robbing China's ocean resources. Since this is an issue which concerns the survival of the Chinese people and the livelihood of our future generations, it is important that we take immediate steps to strengthen our naval forces and speed up our efforts in oceanic development.

Oceanic development covers a wide range of activities including exploration of ocean resources, marine engineering, monitoring the ocean environment, forecasting ocean conditions, monitoring the ocean pollution level, and ocean management and protection. Due to the unique working conditions involved in oceanic development, special transport vehicles and working platforms different from those used on land are required. In particular, the advanced equipment for surveillance, development, and monitoring must rely on the working platforms and transport vehicles capable of operating over the oceans. The SH-5 is one of these transport vehicles and platforms.

The SH-5 aircraft is a Chinese-designed and Chinese-built modern antisubmarine cruise airplane (see Figure 1). This aircraft is primarily designed for the mission of attacking submarines using automatic-homing torpedoes and attacking ships using air-to-ship missiles; but it also performs other functions such as mine deployment, ocean surveillance, transportation, and rescue. It can be converted into a dedicated aircraft for oceanic development by simply removing the fire-control and weapons systems and installing the necessary instruments and equipment for ocean resource exploration and research. This aircraft is powered by four Chinese-built turboprop-5A aircraft engines. Its performance is comparable to that of the land-based ocean remote-sensing aircraft built in the United States, the Soviet Union, Great Britain or Japan (see Figures 2, 3, 4, 5 [not reproduced]).

The SH-5 aircraft can take off and land on the ocean surface; in particular, it has the following design features which are suited for oceanic development missions:

First, the SH-5 has the advanced flight performance of a modern turboprop aircraft with high mobility over water. During over 70 percent of the year, it can perform repeated take-offs and landings over the ocean to carry out a variety of operations; it is a multi-functional, light-weight working platform and transport vehicle.

Second, it has over 50 m^2 of floor space in the fuselage which can carry a maximum payload of 14 tons; its compartment can accommodate a variety of instruments and equipment, and can be modified to provide an environment for different types of operations.

Third, by using the land-based and ocean-based airfields along the coast, the SH-5 can reach any location in the ocean within a 1,500-km radius. The aircraft is equipped with advanced communications, navigation and radar equipment to provide accurate bearing and positioning information over long-range flight. Its range is sufficient to cover all of China's territorial waters.

Fourth,, the SH-5 can perform not only independent operations in the air and on the ocean surface, but also coordinated operations with satellites, ships, and ocean platforms to provide an integrated operational capability.

Fifth, in order to meet the needs of antisubmarine warfare and to fully utilize the capability of its magnetic detection equipment, the SH-5 can cruise at a low altitude of 50 m over the ocean; it also has the maneuvering capability to fully utilize its remote-sensing instruments.

Sixth, generally it is a very difficult task to rescue a land-based aircraft in distress over the ocean; this is particularly true for China because it has no large, carrier-based naval fleet. However, if the SH-5 aircraft encounters trouble at sea, it can land on the ocean for repairs, or wait for assistance, or even glide back to shore. Therefore, it is a safe, self-sustaining aircraft.

As a multi-function aircraft of ocean surveillance, resource development and marine engineering, the SH-5 can be equipped with various instruments to carry out research in different fields such as meteorology, marine hydrology, ocean dynamics, marine physics, marine chemistry, marine biology, marine geology and geophysics. These instruments can also be used for ocean exploration, monitoring, management and technical service.

Specifically, the SH-5 aircraft is designed to perform the following functions:

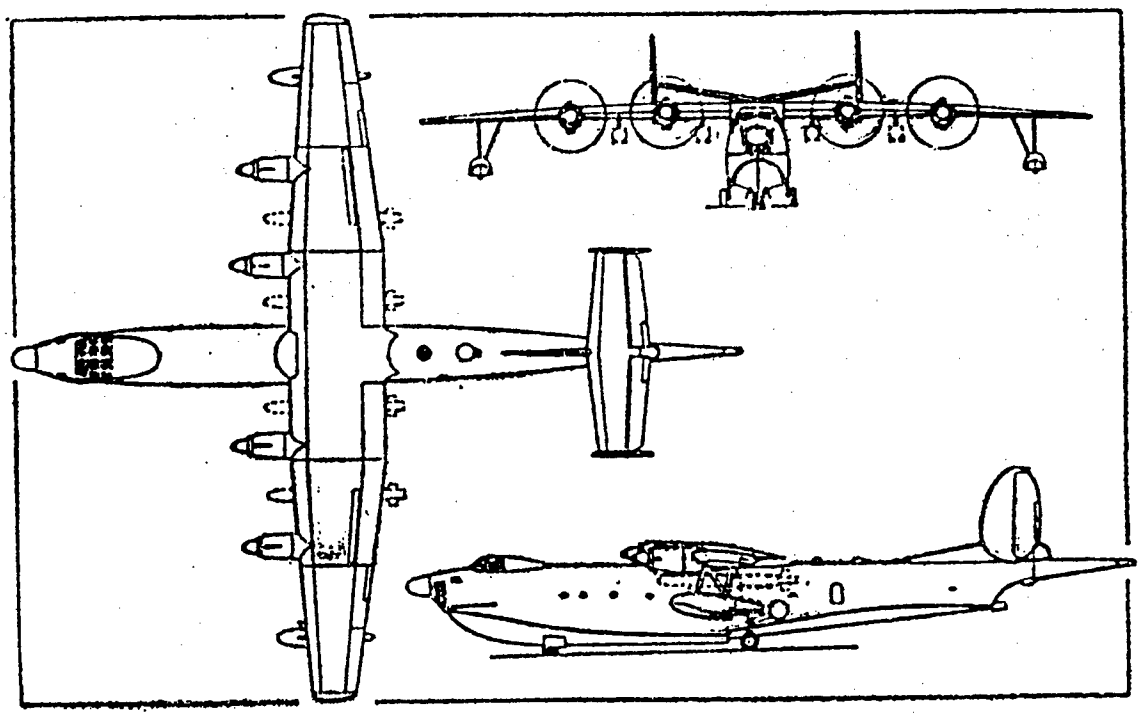

Figure 1. Overall Views of SH-5 Flying Boat

1. Carry out independent resource exploration missions in the areas of geology, mining, meteorology, hydrology and fisheries. For example, it can be equipped with remote sensors and surface detectors to perform the tasks of observation and sampling in the air and on the ocean surface.

2. Coordinate with other observation platforms. For example, it can provide data to verify and supplement satellite observations; it can participate in the flight tests of other spaceborne or airborne remote sensors; it can provide maintenance and repair services and retrieve recorded data for various ocean observation platforms, buoys, and underwater observation stations; it can also provide emergency transportation of equipment and supplies for ships operating at sea.

3. Perform the tasks of ocean patrol and management. In order to maintain China's sovereignty over its ocean territory, we must have the ability to detect the illegal activities of fishing and exploring within our boundaries by other countries and take appropriate actions.

4. Monitor and control ocean pollution. We must patrol and detect activities of dumping waste materials within our boundaries by other ships; we must also closely monitor incidents of leakage from oil tankers or damage to offshore oil wells.

5. Develop ocean tourism. The SH-5 can be converted into a regular passenger plane with a capacity of 80-100 passengers or a luxury model with a capacity of 30-50 passengers. Such an airplane can be used to carry tourists from large coastal cities such as Hainan, Shenzhen, Guangzhou, Xiamen, Fuzhou, Hangzhou, Shanghai, Qingdao, Yantai and Lushun-Dalian. The SH-5 would be an attractive tourist aircraft because of its safety, speed and efficiency.

6. The SH-5 can be converted into a fire-fighting aircraft by carrying up to 10 tons of high-efficiency fire-extinguishing powder and water. Such an aircraft can be used to control fires on oil-drilling platforms, oil tankers or storage tanks in the ocean.

7. The SH-5 can perform search-and-rescue missions by quickly reaching the party in distress, dropping supplies or rescue materials from the air or landing on the ocean to perform direct rescue. The SH-5 would be an effective rescue airplane because of its long range, high speed and large search radius.

As a multi-function aircraft, the SH-5 can undoubtedly perform oceanic development tasks while it is on a patrol mission. On the other hand, as a dedicated oceanic development aircraft, it can also perform military missions such as ocean patrol and surveillance. Therefore, the SH-5 is a high-performance ocean transport vehicle with both military and civilian capabilities.

In order for the SH-5 to carry out all the missions for oceanic development, some improvements must be made which involve a considerable amount of technical difficulties. However, as long as we adhere to the basic principle of "self-reliance and persistence," and make a conscious effort to absorb and digest the advanced technologies from abroad, we are confident that all difficulties can be overcome.

Major Achievements in Biotechnology Reviewed

90CF0348A Beijing BEIJING KEJI BAO [BEIJING SCIENCE AND TECHNOLOGY NEWS] in Chinese 31 Jan, 7 Feb 90

[Article by Zhang Shuyong [1728 2885 1661]]

[31 Jan 90 p 3]

[Text] Biotechnology is attracting great attention and many countries in the world are investing large amounts of money to develop biotechnology. The reason for all this attention is that biotechnology provides new avenues for solving some of the formidable difficulties in the fields of food, nutrition, energy resources, environment and health. Biotechnology will have long-lasting effects on traditional industries and technology and on the reform and adjustment of the industrial structure. It has enormous economic potential and social benefits.

Even though biotechnology has a short history of less than 20 years, it has really prospered on the world scale. It has fostered internally known accomplishments in medicine, agriculture, light industry and food, and its future prospects are bright.

China has given biotechnology a great deal of attention. The field has been listed as a national target area since the Sixth 5-Year Plan. In 1986 it was listed as a national S&T priority area in the Seventh 5-Year Plan and it was listed again as a national S&T research and development area (part of the 863 project) in 1987. Based on the special situation in China, Chinese researchers in biotechnology have closely followed the advances in foreign countries and obtained important progress in the last few years.

In the field of medicine, Chinese researchers succeeded in 1982 in transplanting the genes of adr type hepatitis B virus to E coli using genetic engineering techniques. Subsequently, the surface antigen of hepatitis B virus was expressed in yeast. Recently they have established a vaccinia-virus expression system and a mammal-cell expression system. The vaccine for hepatitis B produced from the vaccinia virus expressor has a number of advantages including wide applicability, no carcinogenic potential, relatively easy extraction and purification, and the availability of a mature industrial base for production. The vaccine has been approved for human clinical tests and intermediate-level testing and research. The hepatitis B vaccine produced from mammal-cell expression system has reached the standards set by the World Health Organization regarding the production of hepatitis B genetic vaccine using hereditary cells. Human tests of this vaccine have shown the same immune effectiveness as a hematogenic vaccine. Preliminary test usage in humans have shown that the vaccine is safe and effective. Phase I and II clinical tests and intermediate-level research are now under way.

The reason why hepatitis B vaccine can make the subject immune for life is that the hepatitis B surface antigen protein (HBsAG) contained in the vaccine has a strong ability to neutralize the virus and thereby prevent the virus from infecting the body. The HBsAG protein has three constituents: the key protein, the intermediate molecule protein, and the large molecule protein. The first-generation hematogenic vaccine and the second-generation genetically engineered vaccine available now both have only the key protein.

Research in recent years has shown that the section between the intermediate molecule protein and the large molecule protein, known as the "front S-zone" is very efficient in neutralizing the antigen and interrupting the virus infection. If a genetically engineered vaccine containing the front S-zone can be produced, the quality of the vaccine will be greatly improved. It has been shown that about 10 percent of people do not respond to vaccines containing only the key protein. Even if these people are injected with first-generation and second-generation vaccines, they are still not immunized. Genetically engineered vaccines containing the "front S-zone" will be effective in these people. This subject is under study by researchers around the world.

Scholars at CAS's Shanghai Institute of Biochemistry have investigated a genetically engineered vaccine containing the front S-zone. After a series of tests they have demonstrated that the reorganized virus strain indeed contains the front S-zone and can form grains in the culture solution. This shows that they have succeeded in reorganizing the virus strain.

Today, both the vaccinia-virus expression system and the mammal-cell expression system have entered the stage of intermediate testing. By the end of 1990, these two lines are expected to be completed and an annual production capacity for 1 million doses will be formed. After mass production begins, a production capacity of 20 to 30 million doses with an output value of 210 million to 320 million yuan can be reached; this will satisfy the immunization needs of all the newborns in China and the high-risk group.

The genetic engineering method of expressing HBsAG in coli and yeast not only allows the production of hepatitis B vaccine, but also permits the generation of hepatitis B core antigen (HBcAG). This antigen may be used in the rapid and reliable testing of hepatitis B. Using HBcAG, the Beijing Biochemical Vaccine Center (under the Beijing Municipal Institute of Scientific Research) has produced diagnostic reagents by radioimmunoassay (RIA), by enzyme-linked immunosorbent assay (ELISA), and by the hemagglutination reaction (HA reaction) method. These reagents are now commercially available throughout China.

In the 1980's, interferon was regarded as the most effective drug against viruses and tumors. Since 1986, interferon has been approved as a new drug for market use by the governments of Britain, Japan, the United States, Italy and Cuba. China formed the alpha-type interferon clone in 1982, obtained effective expressors in

coli in 1983, and achieved purified genetically engineered interferon in 1984. A laboratory was established to produce interferon. Clinic tests of 300 cases of chronic cervicitis and 100 cases of viral keratitis have shown that the drug is 95 percent effective. This αD-interferon for external use will be available on the market before the end of this year. Injection αD-interferon is expected to pass its intermediate testing by the end of next year. Estimates based on the market demand for external-use interferon are for an annual output value of 50 million yuan; the annual output value of the injection interferon will reach 700 million yuan.

In 1958, foreign researchers extracted growth hormone from the human pituitary gland and used the hormone for treating dwarfism, burns, trauma, bone fractures, hemorrhagic ulcers, muscular atrophy, osteoporosis, and obesity. For animals, the growth hormone may be used for increasing the proportion of lean meat and for promoting growth and milk production. The source is too limited for wide use, however.

After the mid-1970's, some countries succeeded in producing synthetic second-generation human growth hormone using genetic engineering methods; the biological activity of the synthetic product is the same as that of the natural product. The synthetic hormone had an extra amino acid not present in the natural product, and people were concerned about side effects. In recent years scientists in the United States and Sweden have produced a third-generation human growth hormone that is identical to the natural product.

The strain obtained by Guo Lihe [6753 4409 0735] of CAS's Shanghai Institute of Cell Research using genetic engineering methods belongs to the newly developed third generation of human growth hormone. The laboratory product was found to meet clinical standards; it will be used in treating patients after intermediate testing and production. The price is much lower than that of foreign products.

The genetic engineering research of penicillin acylase is a new area that developed in the late 1970's. In 1983 Yang Shengli and other researchers at CAS's Shanghai Institute of Pharmacology began the genetic engineering construction of A56 (PAP22) coli expressor of penicillin acylase. With the collaboration of the North China Pharmaceutical Plant, they completed the project at the end of 1987, 1 year ahead of schedule. Intermediate test results showed that the genetically engineered species was active and stable, and its quality was among the best in the world when compared to other similar genetically engineered varieties. Researchers at CAS's Microbiology Institute selected a high-yield specimen of penicillin acylase and conducted intermediate testing with Taiyuan Pharmaceutical Plant. The testing was completed and the product passed certification. Its quality meets the international standards of other known similar products. These research results will allow China to produce fixed penicillin acylase and fixed cells. Based on China's present demand for 6-APA400, there will be an annual savings of more than 20 million yuan and a substantial amount of foreign exchange.

Polyvalent genetically engineered vaccines are an important direction in genetic engineering development. The technique uses the vaccinia as the carrier and incorporates a number of external genes so that an infant receiving the vaccine will acquire immunization against a number of important disease viruses.

The genetic engineering polyvalent vaccine group of the Virus Research Institute of the Chinese Academy of Preventive Medicine has obtained monovalent live vaccine strains for hepatitis B, herpes, and nasopharyngeal carcinoma and has applied for human testing and observation in 1989.

A cooperative effort of the Epidemiology Institute in the Chinese Academy of Preventive Medicine and the Bioengineering Institute in the Chinese Academy of Military Medical Sciences has resulted in a divalent strain formed by transferring the B subunit in the cholera toxin into a typhoid vaccine strain. Tests in pure-bred mice have shown that the composite vaccine can guard against both cholera and typhoid and the rate of protection was 100 percent.

The advantages of monoclonal antibodies manufactured with the hybridoma technique are high specificity, wide application and ease of manufacture. Foreign researchers have now developed thousands of monoclonal antibodies and dozens of commercial products; a new industry is being formed. Today the hybridoma technique is a leading one in China's biotechnology. A joint effort of the Basic Research Institute of the Chinese Academy of Medicine, the Office for Drug Identification of the Ministry of Health, and the Virus Research Institute of the Chinese Academy of Preventive Medicine has led to the successful development and certification of the "7-5" cell virus monoclonal-antibody diagnostic box, the rubella-virus monoclonal-antibody diagnostic box, T-cell and subgroup monoclonal-antibody diagnostic box, the human Ig series diagnostic box, and the hepatitis B surface antigen diagnostic box. Researchers at the Beijing Biochemical Vaccine Center of the Beijing Municipal Institute of Scientific Research have also separated eight strains of hybridoma cells that produce monoclonal antibodies for hepatitis B surface antigen, including one type a and six type d. After matching and sensitizing against type-O human red cells, an R-PHA diagnostic box was produced. The sensitivity was 10 nanograms per milliliter, the specificity was strong and the quality was among the best in China.

Special mention should be made of the toxoprotein called trichosanthin that is purified from trichosanthes. The physical and chemical properties and the primary and secondary structures of this toxoprotein have all been determined. It was reported as a prominent new item in the United States that this toxoprotein can almost completely suppress the reproduction of AIDS virus in vitro. In China there have also been reports

about liver cancer and lung cancer suppressed by trichosanthin. Some American companies have already invested money and are willing to cooperate with China.

As in other countries, the development of transgenic animal and plant research in China is also faster than expected.

To produce transgenic animals, an external gene is injected into a fertilized egg, which is immediately transferred to the oviduct of a surrogate mother. The egg passes through the oviduct and enters the uterus where it grows. After birth, the young stock is tested for an external gene and is called a transgenic animal if the external gene is present. The purpose of breeding transgenic animals is to obtain superior fast-growing domesticated animals with a high lean-meat content and a large egg output. Special proteins with economic value may also be transferred into the animal body to obtain valuable biological products.

In China human growth hormone has been transferred into fertilized eggs of crucian carp, carp, and loach. It was found that the external gene was integrated and expressed in 25 to 60 percent of the offspring. The success of transgenic fish has provided a bright future for breeding superior fish in times to come. Chinese researchers have also succeeded in transferring the gene of the surface antigen of hepatitis B into a fertilized rabbit egg which was then planted into the uterus of a rabbit. Transgenic rabbits with integrated and expressed external genes were produced with this procedure.

Recently China achieved a major advance in research on transgenic animals. Using the egg of a carp as the carrier, human growth hormone was successfully transferred into a fish egg. The rate of integration and expression of the external gene was the highest in the world. China has also cloned the gene of pig and cow growth hormones and has laid a good foundation for further research on transgenic animals.

[7 Feb 90 p 3]

[Text] Methods of cellular engineering have helped China to improve the quality of animals and fish and to enlarge the population of superior species. Good progress has been obtained in embryo transplant for milk cows, in producing twins from the same egg by embryo splitting, and in transplanting half embryos. In the area of nucleus transplant, the nucleus of a carp embryo cell was transplanted into a fish egg with its nucleus removed. The resulting carp/crucian carp had a growth rate 14 to 22 percent greater than its parents and the breeding output was as high as 22 percent.

Advances were also made in animal vaccine and disease diagnostics. Researchers have developed a diarrhea vaccine using a genetic engineering method; this divalent vaccine containing K88 and K99 has been tested on female pigs.

Transgenic plants are produced by transplanting external genes into the bodies of plants. Disease-resistant, high-yield plants engineered for human use have attracted wide attention worldwide. Research in this area has also produced encouraging results.

At CAS's Institute of Microbiology the task group on virus-resistant genetic engineering for plants synthesized a cucumber mosaic virus (CMV). Using Ti particles as an intermediate carrier, they stained tobacco leaves with whole DNA of satellite nucleic acid of CMV; the converted cells have already reproduced. Toxic tests on transplanted tobacco plants with CMV showed that most of the converted plants can be induced to express active nucleic acid. Preliminary observations showed that they were resistant to the invasion of CMV.

In an effort directed toward genetically engineered herbicide resistance, researchers at CAS's Institute of Genetics, assisted by colleagues from CAS's Institute of Botany and the Institute of Crops of the Chinese Academy of Agricultural Sciences, have cloned genes resistant to triazine herbicide from the choloplast DNA bank of a resistant strain of nightshade. Using a 10-layer injection method, they have also introduced the resistant gene into tobacco, soybean and rice. From herbicide and fluorescent light tests, they obtained transgenic plants of tobacco, soybean and rice. Molecular hybridization showed that the choloplast gene of transgenic soybean had integrated the external gene and the resistance is hereditary.

Using the tobacco mosaic virus (TMV) strain, researchers at CAS's Institute of Microbiology have synthesized the full-length DNA gene group of TMV. After the outer-shell protein gene was separated and fully analyzed, the outer-shell protein gene of the TMV was successfully transferred into tobacco with the aid of Ti particles and became integrated into the chromosome of the host. This procedure has produced a strain of disease-resistant plants in China. In the meantime, researchers at CAS's Kunming Institute of Botany used a plant genetic-engineering technique and succeeded in transplanting genes laced with TMV into tobacco plants, thereby producing a genetically engineered tobacco strain resistant to the disease.

Researchers at the Biotechnology Research Center of the Chinese Academy of Agricultural Sciences for the first time transplanted the toxoprotein gene of Bacillus thuringiensis into the protoplast of rice and cultivated normal rice offspring. The existence of Bacillus thuringiensis toxoprotein gene has been verified in the rice tissue, hence providing new prospects for pest-resistant rice.

The technology of protoplast reproduction of plants is an important basis for cellular hybridization and for introducing external genes. Protoplast regeneration of grass-family and bean- or pea-family plants has been an internationally recognized difficult problem. China has made good progress in this area. CAS's Institute of

Genetics and CAS's Shanghai Institute of Plant Physiology have obtained regenerated plants from rice protoplast. CAS's Institute of Botany has obtained protoplast-regenerated corn. CAS's Genetics Institute and the Cereal and Oil Office of the Hebei Institute of Agriculture obtained protoplast-regenerated wheat. Protoplast-regenerated soybeans were obtained by the Shanghai Institute of Plant Physiology and at Fudan University researchers obtained protoplast-regenerated red beans. These achievements all meet international standards, and will bring a promising future for China in terms of cultivating transgenic plants and high-quality hardy crops.

Chinese scientists have used biotechnology in producing a series of new strains and species of agricultural plants. The land under cultivation with "Zhonghua No 10" northern rice, developed by researchers at the Crop Institute of the Chinese Academy of Agricultural Sciences, has been increased to 2 million mu; this has raised output by 16 million jin [1 jin = ½ kg]. Hu Daofen [5170 6670 5358] and coworkers at the Plant Cell Engineering Laboratory bred the "Jinghua No 3" winter wheat for northern China. The variety was promoted on 410,000 mu; this increased output by 20.5 million jin. The economic benefits of the output increase owing to these two species was about 14.60 million yuan.

The research advances described above have shown that bioengineering researchers in China are making active contributions to the health of mankind.

Eleven-Year Rice Blast Bacteria Pathogenicity Study

90WE0173A Guiyang GUIZHOU AGRICULTURAL SCIENCES in Chinese No 1, 15 Feb 90 pp 21-24]

[Article by Zhou Weijia [0719 4850 0163], Zeng Lingxiang [2582 0109 4392], Dai Jiyue [0108 4949 6460] and Xie Haicheng [6200 3189 0701], Paddy Rice Research Institute, Guizhou Provincial Agricultural Sciences Academy, Guiyang]

[Abstract] In 1988, the authors of this article separated five to ten microspores from each of 10 rice blast bacteria monospore strains that they had separated and preserved in 1978. They assayed a total of 80 such monospore strains using seven Chinese identifier varieties. Results showed that the preserved monospore strain of each microspecies differentiated to form numerous microspecies. The tendency toward change in pathogenicity of individual identifier varieties went from stable to weakening, to strengthening. Different bacteria strains differed substantially in their pathenogenicity. The pathenogenicity of indica microspecies weakened more than that of japonica microspecies, but the stability of their pathogenicity was poorer than that of japonica microspecies.

This more than three page article details the materials and methods usually found in such papers, as well as the results obtained and a discussion of them. It also provides a discussion of the screening of stable bacteria strains. Three tables concisely summarize pathenogenicity reactions, and changes in pathogenicity of the monospore strains under different circumstances.

Survey of Some Wild Vertebrates Susceptible to Infectious Pathogens

90WE0175A Lanzhou ZHONGGUO SHOUYI KEJI in Chinese No 1, 20 Jan 90

[Article by Li Fuyu [2621 1381 5148] and Zhao Jiawei [6392 1367 0251], Tongjiang County Animal Husbandry Bureau, Sichuan Province; and He Yijiang [0149 6318 3068], Tongjiang County Health and Epidemic Prevention Station: "Survey Report on Infectious Pathogens and Susceptible Dangerous Wild Invertebrates"]

[Abstract] From 1982 through 1987, the authors conducted a survey of infectious pathogens and susceptible dangerous wild invertebrates in the Daba Shan hinterland on the northern fringe of the Sichuan Basin. The Chongqing Natural Sciences Museum and the Nanchong Teachers Training College supported their research, one purpose of which was to provide data on the treatment of diseases in man and domestic livestock stemming from the same pathogens. They dissected animals, applied bacteriological, serological, and immunological methods, and gave experimental inoculations in their work.

They found 44 vertebrates susceptible to naturally occurring pathogens, including 26 animals, 10 birds, five reptiles, and three fish. The article gives the Latin names of each of the creatures susceptible to various including those that produce leptospirosis, brucella, tularemia, histoplasmosis, hog cholera, swine erysipelas, and New Castle disease of fowl.

In a brief discussion at the end of this nearly two page article, the most common carriers of some of the most prevalent diseases are identified. All references cited are Chinese works dating from 1965 through 1982.

First Domestic All-Digital "Galaxy" Simulator Certified

90P60009 Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 17, 2 May 90 p 1

[Article by Xiang Hanyuan [0686 3352 3293]: "First All-Digital Galaxy Simulator Passes Appraisal"]

[Text] Ten all-digital Galaxy simulators have already been sold, at a price of some 13 million yuan each. The University of Science & Technology for National Defense, the unit which developed and manufactured the simulator, has put forth much effort toward popularizing its applications: over the course of development, the university provided over ten units with free computer time, technical guidance, and technology tracking services, as well as with extended software capacity.

Reports of Home-Made Computer Viruses

40100054B Beijing CHINA DAILY in English 21 Mar 90 p 3

[Article: "Thou Shalt Not Bug Computers"]

[Text] People who create computer viruses are likely to face penalties in China as the Ministry of Public Security is drafting laws and regulations to fight against the practice, the Beijing-based SCIENCE AND TECHNOLOGY DAILY reported.

The paper quoted experts from the ministry as saying that "home-made computer viruses" have been seen many times in China.

It said that the "No 1 Chinese virus," a new kind of computer virus made by a college student through modifying an imported foreign virus in South China's Guangdong Province had already spread to many of the province's important units.

Although the virus has not caused serious losses thanks to the timely measures taken, from now on, special attention must be paid to the problem, experts urged.

Survey

Unlike some viruses from abroad which break out at certain periods, the "home-made virus" usually damages all of the users' stored data within a minute, the experts warned.

Creators of the computer virus although might be sent to jail for as long as 10 years in some foreign countries, the inventor of the "No 1 Chinese" escaped from any legal penalties because China has neither laws nor administrative regulations concerning them at present, the paper said.

A sample survey by the Ministry of Public Security found that 20 per cent of the total 12,750 investigated computers were afflicted by a variety of international viruses.

As a result, few units have to give up restoring their business data into computers though the country has already been able to verify more than 50 viruses with its currently developed software which could eliminate 7 virus, the report said. (CD News)

CAS To Launch New Ventures Overseas

40100054C Beijing CHINA DAILY (Business Weekly) in English 21 May 90 p 4

[Article by Xiao Ren]

[Text] The Chinese Academy of Sciences (CAS) is seeking a firm foothold in the world computer software market through co-operation with other countries.

Zhang Youla, deputy director of the academy's Institute of Software, said the academy hoped to set up two joint ventures this year—one in Japan and the other in the United States.

The academy had contacted five Japanese firms which had shown interest in the idea of co-operation, he said.

If things went smoothly, he added, the joint venture in Japan would probably be set up before the end of the year.

With a total investment of around $200,000, the venture would develop computer software for the Japanese market.

The Chinese would concentrate on the development of new computer software, while the Japanese would lay more emphasis on management and sales promotion.

Zhang said negotiations were also under way between the academy and some US firms about the setting up of the joint venture in the United States.

"Setting up overseas joint ventures will put our products much closer to the world market," said Zhang.

The academy had set up several Sino-foreign joint ventures for the development of new software in China, he said.

The Institute of Software itself set up two software joint ventures in Beijing last year in co-operation with the United States and Austria.

And a Japanese firm was also thinking of setting up a software joint venture in China, according to a report in a Japanese newspaper.

Zhang said customers asking the academy to develop software for them were mainly from Japan, the United States and Singapore.

Colleges To Get 3Com's Software

40100054A Beijing CHINA DAILY in English 14 May 90 p 2

[Text] The 3Com Company, a major computer network software supplier headquartered in Santa Clara, California, decided recently to donate its 3-Open network software to five mainland Chinese universities and colleges.

The five chosen to receive the donated software are Qinghua University, Harbin Science Institute, Northeast Science University, Chengdu Science and Technology University and Hubei Finance and Economical Institute.

Each university will receive a set of 3-Open LAN Manager 1.1 network software.

The donation was part of the 3Com's efforts to help China train professionals in computer and information science, said William Messer, the general manager in charge of the company's Asian operations.

The 3-Open LAN Manager would also be used by these universities to undergo various research in developing networks, Messer said.

He hoped that the universities will use the software to further develop some value-added software in Chinese.

Direct Step-and-Repeat Projection Photoetching Machine Developed

90P60004 Beijing ZHONGGUO DIANZI BAO [CHINA ELECTRONICS NEWS] in Chinese 6 Apr 90 p 1

[Article by Deng Xianchun [6772 6343 2504]]

[Summary] One of the key projects in the State's Seventh 5-Year Plan, a direct step-and-repeat projection photoetching machine, developed by the Chinese Academy of Sciences' (CAS) Institute of Optoelectronics Technology, passed the CAS-sponsored preliminary appraisal in Chengdu on 13 March. Its main technical parameters meet international standards of the mid eighties. This equipment for the production of large-scale integrated [LSI] circuits was independently designed and developed by the institute in a 6-year-plus project begun in 1983—a project in which the design was carried out without the benefit of similar machines for reference, without imported technology, and with insufficient fabrication data.

The prototype has three functions: coaxial gradual-field alignment (or registration), television full-field alignment, and manual alignment, and can operate in a completely automatic mode. Limiting resolution is 0.8 micron, practical photoetching line width is 1.25 microns, coaxial alignment precision is 0.24 micron, and silicon-chip predetermined positioning accuracy is better than 40 microns; 39 3-inch silicon chips can be processed per hour with this equipment.

Record Critical Current Density Achieved

Report from Beijing Institute

90P60005 Beijing GUANGMING RIBAO in Chinese 21 Apr 90 p 1

[Article by Wu Yali [0702 7161 7787]: "China's Superconductivity Research Once More Is at the Forefront Internationally"]

[Summary] The Beijing Institute of Nonferrous Metals (BINM) has reported a world-class achievement in high-temperature superconductivity research. On April 2, using a bulk YBaCuO sample prepared by a molten-texture method, at a temperature of 77K and a magnetic field strength of 2 tesla, a BINM research group led by Senior Engineer Ren Hongtao [0117 3163 3447] measured a dc current density of 23,760 amperes per square centimeter, a value far surpassing data heretofore reported worldwide. The experiment was confirmed the other day by a test at the State Superconductivity Center.

This achievement comes less than a month after Ren's group had reported another successful experiment. On 7 March, the group measured a current density of 7,560 amperes per square centimeter in the presence of a 1-tesla field.

Measurement Confirmed by CAS

90P60005 Beijing KEJI RIBAO [SCIENCE AND TECHNOLOGY DAILY] in Chinese 25 Apr 90 p 1

[Article by Huang Yong [7806 0516]: "New Breakthrough in China's Superconductivity Research"]

[Summary] The critical current density value of 23,800 amperes per square centimeter for a bulk YBaCuO superconductor—a value reported by Ren Hongtao's research group at the Beijing Institute of Nonferrous Metals (BINM)—has been confirmed by scientists at the Chinese Academy of Sciences' (CAS) Institute of Physics. Using a sustained direct-current four-lead method, the CAS researchers confirmed the BINM finding in three separate measurements. Chief Expert of the State Superconductivity Expert Commission and Beijing University Professor Gan Zizhao [3927 1311 6856] remarked that the BINM's breakthrough "means a great stride forward into the era of applied superconductivity."

Structural Phase Changes in Bi-Based Superconductors Near 210K

90FE0070A Beijing KEXUE TONGBAO in Chinese Vol 35 No 3, [1-15] Feb 90 (MS received 18 Apr 89, revised 14 Jun 89) pp 177-180

[Article by He Yusheng [0149 6276 3932], Xiang Jiong [0686 3518], and Wang Xin [3769 2946] of the Department of Physics, Qinghua University, Beijing 100084; He Aisheng [0149 5337 3932] of the Basic [Science] Department of Northern Polytechnical University, Beijing 100044; and Zhang Jincang [1728 6855 0221] and Chang Fanggao [1603 2455 7559] of the Department of Physics, Henan Teachers' University, Xinxiang 453002]

[Text] Key words: Bi-based superconductors, ultrasound measurement, specific heat experiment, X-ray diffraction experiment, structural phase changes.

A systematic study of Bi-Sr-Ca-Cu-O systems (including four series of specimens involving lead-doped and undoped 80K and 110K phases) was done recently using ultrasound and other techniques. For the first time, it has been found that Bi-based superconductors might have possible structural phase changes near 210K.

Single-phase polycrystalline $Bi_2Sr_2Ca_1Cu_2O_{8+x}$, $(Bi_{0.85}Pb_{0.15})_2Sr_2Ca_1Cu_2O_{8+x}$, $Bi_2Sr_2Ca_2Cu_3O_{10+x}$, and $(Bi_{0.85}Pb_{0.15})_2Sr_2Ca_2Cu_3O_{10+x}$ specimens were used in the experiments. The lead-containing specimens were prepared in our laboratory. Reagent-grade powders of Bi_2O_3, PbO, $SrCO_3$, $CaCO_3$ and CuO were dried, mixed in proportion and pre-heated in air at 780-820°C for 12 hours. After pre-sintering, they were ground into powder again and pressed into 13-mm-diameter 3-4-mm-thick pellets. The pellets were placed in a tube furnace and sintered in air at 800-880°C for 60-120 hours and then cooled down to room temperature in the furnace. Temperature fluctuations had to be rigorously controlled during sintering and the oxygen partial pressure should be properly reduced.[1] X-ray analysis results showed that the specimens are either the 2212 or 2223 phase. The zero-resistance temperature of the low-temperature phase (2212) is T_{co} = 74-85K and that of the high-temperature phase (2223) is T_{co} = 107-112K.

Beijing University and China Science and Technology University provided a few lead-free specimens prepared by a variety of methods.

A MATEC 7700-series ultrasonic speed and attenuation measurement system was used in the variable-temperature ultrasound experiment. A 5, 10, or 15 MHz quartz or lithium-niobate transducer was used and it was coupled to the specimen by Nonaq grease to generate a longitudinal or transverse ultrasound signal.

The low-temperature environment was obtained by either of the following two ways. One was to use a closed circulating refrigeration unit (Air Products, USA). The specimen was in a 0.67-Pa vacuum. The temperature can be varied over a range between 300-10K and the rate of temperature change is less than 0.5-0.3K/min. The accuracy of temperature control is better than Δ = +/- 0.1K. The other way is to use a conventional liquid-nitrogen Dewar container and use nitrogen gas as a heat exchanger. The range of temperature variation is 300-80K. Experimentally, it was found that these two devices produced identical ultrasound results.

The measurement of sound speed was done using a pulse-echo superposition method and its error is of the

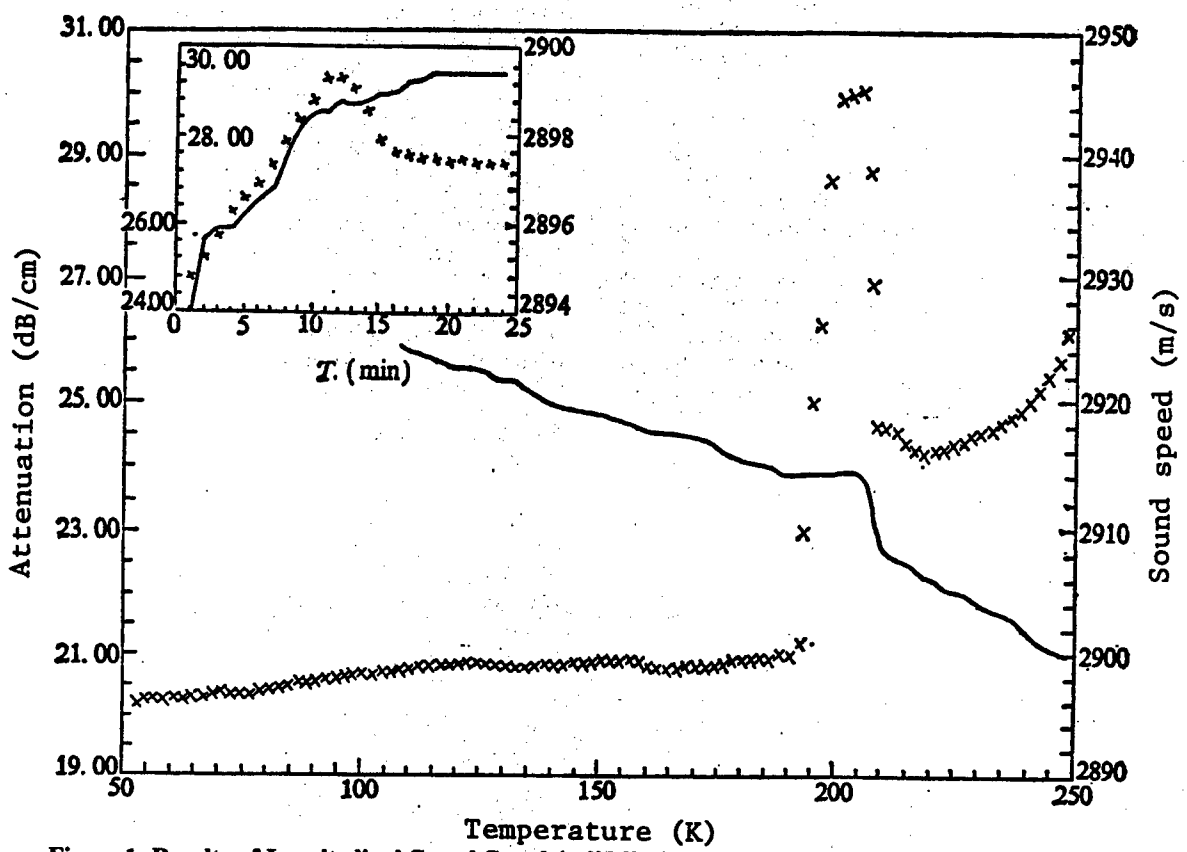

Figure 1. Results of Longitudinal Sound Speed (solid line) and Attenuation (x) with the $(Bi_{0.85}Pb_{0.15})_2Sr_2Ca_2Cu_3O_{10+x}$ Specimen During Cooling. Ultrasound frequency: 10 MHz.

The left upper corner shows the ultrasound speed (solid line) and attenuation (x) results as a function of time over 25 minutes while the specimen was maintained at 209.0 +/- 0.1K.

order of 10^{-4}. A dual-echo comparison method was used to measure attenuation and its error is less than +/- 0.02dB.

Figure 1 shows the results of the temperature-dependent longitudinal ultrasound measurements. The speed of sound was found to vary monotonically with temperature. However, it rose steeply near 210-208K and dropped slightly near 190K, forming a small peak. In addition, the attenuation also rose and declined sharply in the same temperature region, creating a sharp peak. Figure 2 shows the results of the temperature-dependent transverse ultrasound measurements. Compared to Figure 1, the results are essentially consistent with those shown in Figure 1. The same specimen showed an apparent thermal latency during heating. The abrupt change occurred at 235-243K. Measurements made at other frequencies (5-15 MHz) showed that the height of the abnormal peak increased with rising ultrasound frequency. However, the position of the peak did not move.

Experimentally, it was demonstrated that the sharp changes in the curves shown above took place within 0.1-0.2K. Hence, this might be an isothermal process. Normally, a specimen could reach thermal equilibrium within 2 minutes for a 1-2K change. However, in the midst of such a sharp change, the sound speed and attenuation varied over 20 minutes at the same temperature (see the curves in the upper left corner of Figure 1). This indicates that the specimen was undergoing some internal structural change which is a gradual isothermal process.

Specimens supplied from different laboratories have been used and the same results were repeated. Therefore, this effect is independent of the fabrication technique.

In order to investigate the physics of this isothermal change, thermal analysis experiments were carried out. A change of specific heat was observed between 230 and 245K during heating. However, there are no endothermic (and exothermic) peaks. This is characteristic of a second-order phase transition. High-accuracy specific-heat measurements were made at the China Institute of Metrology with a Pb-containing single-phase 2223 specimen that was prepared in the same batch as the specimen used in the ultrasound experiment. The above results were totally reconfirmed. An abrupt

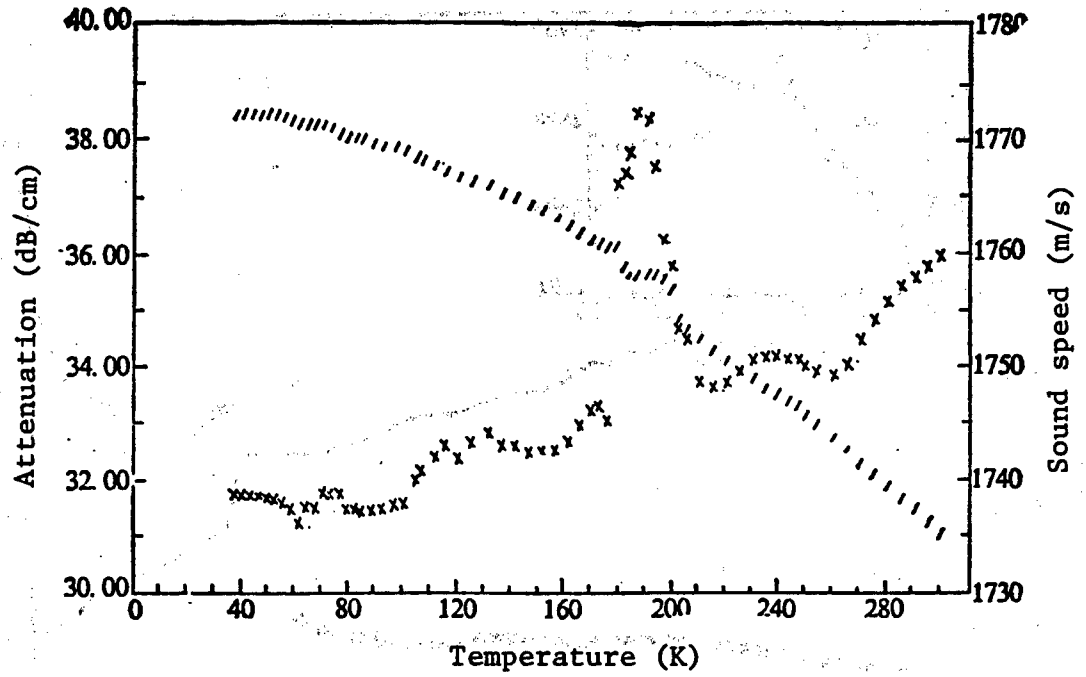

Figure 2. Results of Transverse Sound Speed (slant line) and Attenuation (x) with the $Bi_2Sr_2CaCu_2O_{8+x}$ Specimen During Cooling. Ultrasound frequency: 15 MHz.

change of the specific heat was found to be at 210K and the specific heat was found to vary by $\Delta C_p = 20$ J/mol-K (see Figure 3).

X-ray experiments were conducted as a function of temperature (room temperature to 80K) with the above specimen. No new X-ray diffraction peaks were seen, indicating that the basic structural framework did not change. However, the lattice constants were found to be abnormally large near 210K. Obviously, some fine structural changes might have taken place near 210K.

In April 1987, a possible structural phase transition process was first observed in the ultrasound study of the $YBa_2Cu_3O_{7-y}$ (see He Yusheng et al., Application submitted to the Chinese National Natural Science Foundation, report presented at the High-T_c Superconductivity Meeting for seven higher-learning institutions sponsored by the State Education Commission, April 1987). For the first time, it was pointed out that this anomaly occurred in the vicinity of T approximately = $2T_c$. In the thermal analysis, specific-heat, X-ray diffraction and electron-diffraction experiments that followed, we also discovered abnormal changes of specific heat[2] and lattice constants[3] in the temperature range where abnormal ultrasound speed and attenuation were observed. These effects have been confirmed by other experiments.[4,5] Similar changes are being observed in the Bi-based materials. This suggests that some lattice instability exists near $2T_c$ which might be a general characteristic of the high-T_c perovskite superconductors. Nevertheless, the structural change of $YBa_2Cu_3O_{7-y}$ is a relatively slower process. Its ultrasound attenuation peak is broad and gradual and its lattice constants are unstable over the broad temperature range.[3] This should be related to the migration of its internal oxygen atoms and the re-arrangement of order. It is a slow process. However, the Bi-based superconductors do not have any one-dimensional Cu-O bond and oxygen-atom diffusion has never been observed in these materials. Hence, some believe that the structural change might be associated with the extension or inclination of certain bonds (such as Cu-O or Bi-O) or the displacement of certain atoms (such as Bi or O). Therefore, it is a relatively fast process and the ultrasound attenuation peak is steep and narrow.

Acknowledgement: The authors wish to thank Associate Professor Wei Chongde [5898 1504 1790] of Beijing University and Associate Professor Hu Jiankai [5170 1696 0418] of China Science and Technology University for providing some specimens. The work was supported by the Chinese National Superconductor Research and Development Center, Chinese National Natural Science Foundation, and the Academy of Sciences of the Third World.

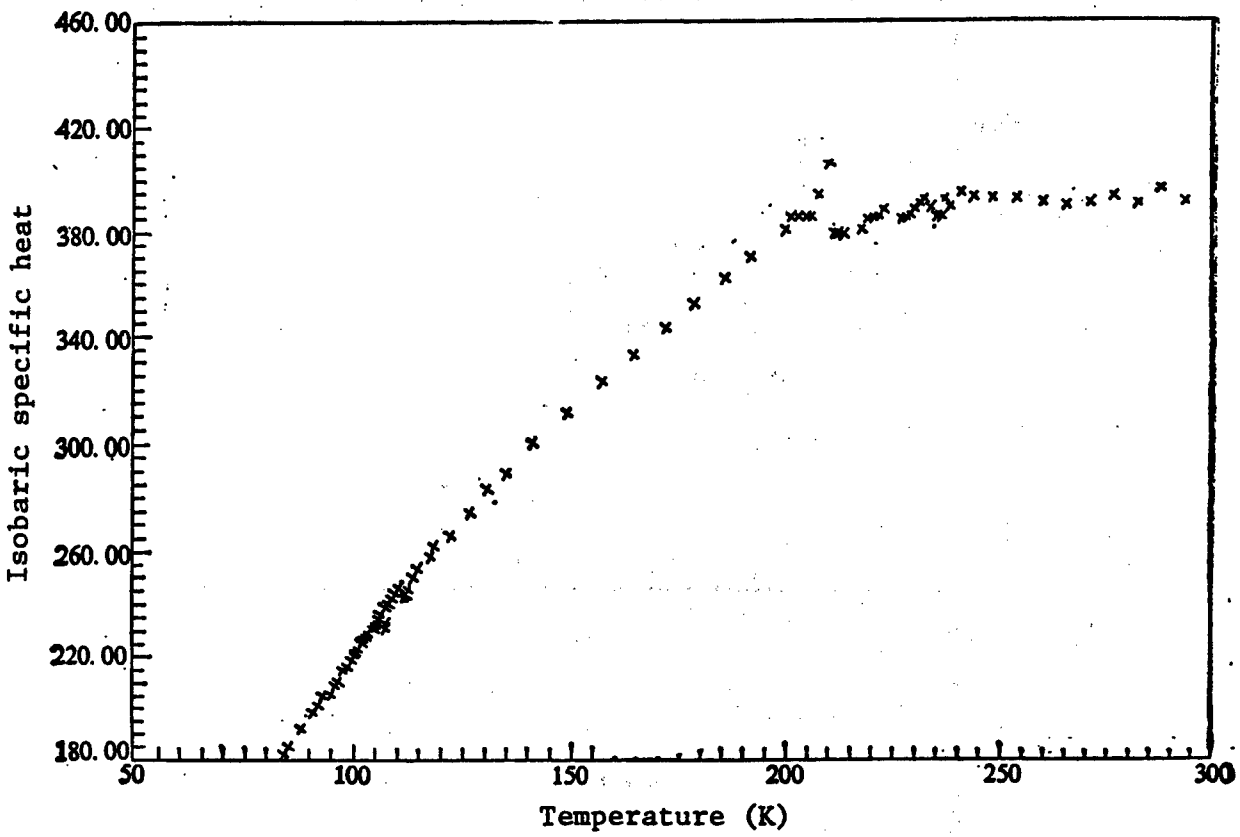

Figure 3. Specific Heat Results with $(Bi_{0.85}Pb_{0.15})_2 Sr_2Ca_2Cu_3O_{10+x}$

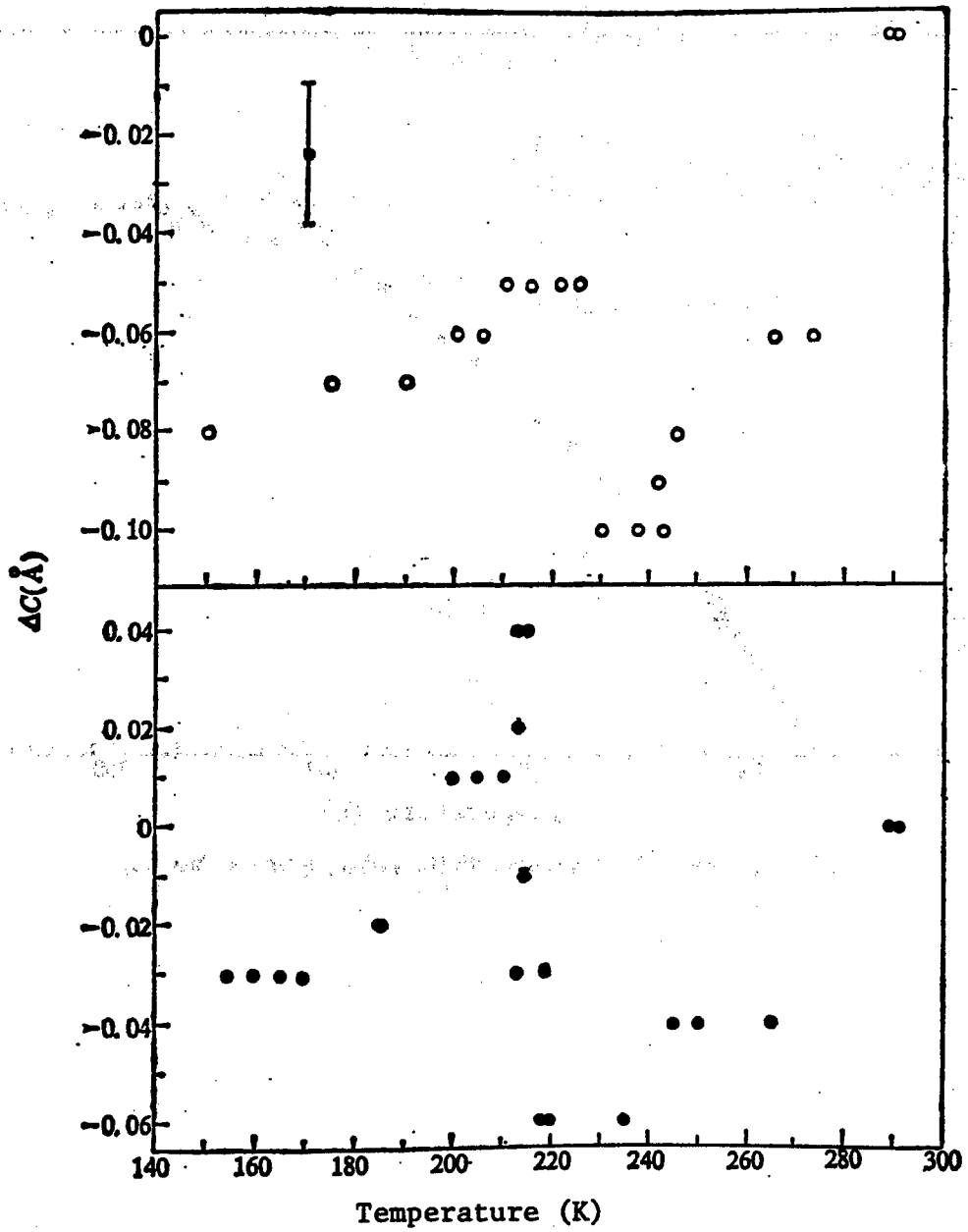

Figure 4. Variation of the C-axis of the $(Bi_{0.85}Pb_{0.15})_2 Sr_2Ca_2Cu_3O_{10+x}$ Specimen as a Function of Temperature from X-ray Experiments

filled circle: during cooling, o: during heating

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Experimental Overhead Fiber-Optic Cable for Jilin Province

90P60006 Beijing KEJI RIBAO [SCIENCE AND TECHNOLOGY DAILY] in Chinese 8 May 90 p 2

[Article by Zhao Taichun [6392 3141 2504] and Wu Yaozong [0702 5069 1350]: "China's First Long-Distance Experimental Overhead Fiber-Optic Communications Cable for the High, Cold Areas"]

[Summary] Work on a fiber-optic cable linking Jilin City and Yongji Xian—China's first long-distance experimental overhead fiber-optic cable project for high, cold areas—formally began a few days ago. The project, being jointly constructed by the Jilin Province Posts & Telecommunications Management Office and the Ministry of Posts & Telecommunications' Wuhan Institute of Posts & Telecommunications Science, is 32.5 kilometers long, uses a domestically manufactured 1.3-micron-wavelength single-mode 8-fiber optical cable, and is designed to withstand temperatures of minus 40° C. Optical cable and terminal equipment are being furnished by the Wuhan Institute. This project, which will provide 72 long-distance fully automatic direct-dial telephone lines, is scheduled to be completed within 5 months.

CCTV Gets Satellite Station

40100055 Beijing CHINA DAILY in English 19 May 90 p 3

[Article by Li Hong]

[Text] An earth-to-satellite station for television transmissions was formally opened yesterday in Beijing.

The Beijing International Earth Station for Television Transmission will be used mainly for exchanges between CCTV (China Central Television Station) and OIRT (the Organization of International Radio and Television).

Completion of the station marks another major success which China has achieved in the application of satellite technology, following its successful launch of AsiaSat-1 on April 7 this year, Liu Jiyuan, vice-minister of Aerospace Industry, said at the opening ceremony.

The earth station, produced by the Ministry of Aerospace Industry and entrusted by the Ministry of Radio, Film and Television, transmits television signals via No 10 transponder of the Soviet Union's Geostationary Satellite-13, which is located at 80 degrees east longitude above the Indian Ocean.

It is learned that the 11th Asian Games to be held in Beijing in September will be televised live to television stations of the Soviet Union and other Eastern European countries, members of OIRT, with the help of the transmission of the Beijing earth station.

The earth station has one video channel, two audio channels, one service telephone line and two 4-line communications telephones. The telephone lines are expected to be put into operation in July.

Discussions on Intensity, Attenuation of γ-Families Observed by Mountain Emulsion Chamber

40090019a Beijing GAONENG WULI YU HE WULI [HIGH ENERGY PHYSICS AND NUCLEAR PHYSICS] in Chinese Vol 15 No 4, Apr 90 pp 296-302

[English abstract of article by Zhu Qingqi [2612 3237 2759], Ding Linkai [0002 2651 1052] et al., of the Institute of High Energy Physics, Chinese Academy of Sciences]

[Text] By analyzing the various factors which affect the intensity of γ-families as observed by means of a mountain emulsion chamber and comparing the experimental data with the results of Monte-Carlo simulation, the inference that the proton fraction in the primary chemical composition at the UHE region, i.e., 10^{15} eV, is approximately 30 percent has been proven acceptable.

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Measurement of Fast Neutron Capture Cross Sections of Natural Nuclei Ta, In

40090019b Beijing GAONENG WULI YU HE WULI [HIGH ENERGY PHYSICS AND NUCLEAR PHYSICS] in Chinese Vol 14 No 4, Apr 90 pp 340-344

[English abstract of article by Xiang Zhengyu [0686 2973 3842], Li Yexiang [2621 2814 4382], et al., of the Institute of Nuclear Science and Technology, Sichuan University, Chengdu]

[Text] The neutron capture cross sections of Ta and In were measured in the energy range of from 0.34 to 1.68 MeV. A large liquid scintillator detector was used to detect the prompt capture γ radiation. Two long-counters were used to monitor the neutron flux. In order to reduce the background, the fast coincidence between the two half-spheres of the detector and the time-of-flight technique were used. The capture cross sections of Ta and In were determined relative to the standard cross section of Au. These results have been compared with others, and are discussed.

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Research on ^{88}Y(n, 2n) Reaction Cross Section

40090019c Beijing GAONENG WULI YU HE WULI [HIGH ENERGY PHYSICS AND NUCLEAR PHYSICS] in Chinese Vol 14 No 4, Apr 90 pp 366-371

[English abstract of article by Huang Feizeng [7806 2431 1073] and Shi Zhaomin [2457 0340 3046] of the Institute of Heavy Ion Physics, Beijing University; Lu Hanlin [4151 3211 2651], et al., of the Institute of Atomic Energy, Beijing]

[Text] The cross sections of the neutron induced (n, 2n) reaction on the unstable target nucleus ^{88}Y in the energy range of from 10.3 to 17.4 MeV are obtained from the measurement of the ^{87}Sr (d, 2n) reaction. This research is based on the hypothesis that the formation of the compound nucleus is independent of its decay. The results are compared with the authors' calculations, as well as with the experimental data and the calculated results obtained by Prestwood's group. The comparison indicates that this topic merits further study.

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Optimization of BEPC Positron Source

40090017a Beijing GAONENG WULI YU HE WULI [HIGH ENERGY PHYSICS AND NUCLEAR PHYSICS] in Chinese Vol 14 No 2, Feb 90 pp 110-117

[English abstract of article by Pei Guoxi [5952 0948 3886], Xie Jialin [6200 1367 7792], et al., of the Institute of High Energy Physics, Chinese Academy of Sciences, Beijing]

[Text] Based on Monte-Carlo simulation and particle tracking, the BEPC positron source has been designed and the predicted performance is compared with experimental measurements, with good agreement. Important conclusions can be drawn from the study presented in this paper, such as up to a 10 A increase in the electron gun current is beneficial in spite of the deterioration effect on the beam spot size at the target; the positron current increase with the bridge coil and solenoid currents of the positron of the matching field peak with the target; the existence of injection phases and their significance; the electron and positron from the target do not have to be separated; the RF separator is not necessary, etc. The above results serve the purpose of directing the tune-up and operation of the BEPC, providing a useful reference for the future design of positron accelerators.

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Electron Cyclotron Wave Heating Experiment on CT-6B Tokamak

40090015a Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 39 No 3, Mar 90 pp 399-407

[English abstract of article by Luo Yaoquan [5012 5069 0356], Wang Long [3769 7893], et al., of the Institute of Physics, Chinese Academy of Sciences, Beijing]

[Text] Obvious heating effects have been observed in RF heating experiments with the CT-6B tokamak in which microwave beams of frequencies 34.34 GHz and 20.1 GHz, generated by two gyrotron systems, were launched

from the top and outside of the device, respectively. It is shown that these heating effects arise because of the different heating mechanisms. The former is due mainly to the resonance heating of the O-mode, while the latter involves downshift-over dense heating. Its heating mechanism may be the nonlinear phenomenon occurring near the high-density cut-off layer of the X-mode. A kind of nonlinear phenomenon (secondary heating) has been observed in two experiments, which may represent different physical mechanisms.

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Diamond-like Carbon Films Implanted with Various Ion Energies

40090015b Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 39 No 3, Mar 90 pp 420-423

[English abstract of article by Xiang Jinzhong [7309 6855 6988], Zheng Zhihao [6774 1807 6275], et al., of the Department of Modern Physics, Lanzhou University, and the Ion Beam Laboratory, Shanghai Institute of Metallurgy, Chinese Academy of Sciences]

[Text] Diamond-like carbon (DLC) films, prepared by RF plasma CVD [chemical vapor deposition], were implanted at a dose of 5×10^{15} Ar/cm^2 with ion energies of 50, 100, 140, and 180 keV. Before and after ion implantation, the IR absorption spectra, Raman spectra, optical gap E_{opt}, hydrogen contents and resistivities were measured. The results show that the C-H bonds were destroyed and sp^2 and sp^3 components decreased during implantation, while the ratio of (sp^2/sp^3) increased with the ion energy. The E_{opt}, resistivities and hydrogen contents decreased with the increasing ion energy. However, at 180 keV, the above parameters underwent no evident changes. These results are also discussed in this paper.

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